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EXAMINER
DI GRAZIO, JEANNE A

ART UNIT	PAPER NUMBER
2871	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/529,159	Applicant(s) BRYAN-BROWN ET AL.	
	Examiner Jeanne A. Di Grazio	Art Unit 2871	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-59* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-59* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 June 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Specification

This application does not contain an abstract of the disclosure as required by 37 CFR 1.72(b). An abstract on a separate sheet is required. *Please also note grammatical and or spelling corrections made to the specification.*

Claim Objections

Claims 6, 14-17, 18, 20, 21, 22, 24, 25, 29, 33, 34, 39-41, and 49 are objected to because of the following informalities. Appropriate correction is required.

Per claim 6: Missing a period (.) at the end of the claim.

Per claims 14-17: Improper dependency / depend on wrong claim. Claims 14-17 (method claims) depend on claim 11 (apparatus) when the claims should depend on claim 13.

Per claim 14: Please change the word "fluid" to "material" because this is how the other dependent claims read (with "material").

Per claim 16: Extraneous word "to."

Per claim 18: "stated" should be "state" and following the transitional phrase "comprising" there should be a ":" instead of a ";".

Claim 20 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 20 recites a means for reducing zenithal anchoring energy as an oligomer incorporated into the LC material; however, the previous claim (19) also recites that such an oligomer may be added to the LC material. "Added to" and "incorporated" have similar if not identical meanings.

Per claim 20: Extraneous word "and."

Claim 21: The Examiner notes a difference in spelling between the specification and claim 21 concerning "MXM035." In numerous locations within the specification, Applicant refers to "MXM035"; however, in claim 21, Applicant refers to "MMXM035."

Claim 22 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 22 recites a means for reducing zenithal anchoring energy of a material containing esters, thiols, and/or acrylate monomers; however, claim 21 recites Norland 65 as a means for reducing zenithal anchoring energy and Norland 65 contains esters and/or acrylate monomers.

Per claim 25: "azimthal" should be "azimuthal."

Per claim 29: "surface" should be "surfaces."

Per claim 33: Following the transitional phrase "comprising" there should be a ":".

Per claim 34: Missing a period (.) at the end of the claim.

Per claims 39-40: Needs "and" following "concentration."

Per claim 41: Repetitive words "is a material."

Per claim 49: Missing a period (.) at the end of the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Per claims 1 and 44: A layer of (smectic) LC material contained between two spaced cell wall carrying electrodes structures and an alignment treatment on at least one wall (to give both alignment and surface tilt for smectic) characterized by means for reducing anchoring energy at the surface alignment on one or both cell walls.

Claims 1 and 44 are rejected under 35 U.S.C. 102(e) as being anticipated by Bryan-Brown et al. (USPN 5,754,264). Bryan- Brown et al. discloses the use of grating surface alignment as a means of controlling (increasing or reducing) anchoring energy [Col. 2, Lines 24-25 and Lines 29-31].

Claim Rejections - 35 USC § 102 / § 103

Claims 7-9, 11-12 and 50-52 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Bryan-Brown et al. (USPN 5,754,264) in view of Wu et al. (USPN 5,661,533).

Per claims 7-9, 11-12 and 50-52: the oligomer or polymer is …

- substantially non-crystalline within the LC material
- reduces the LC material order parameter at or adjacent the cell walls
- changes the phase of the LC material at or adjacent the cell walls
- is substantially linear or includes branch points, either with or without crosslinking
- has a number of repeat units within the range of 4 to 1000

When an oligomer or polymer is substantially liquid-like it may also be substantially non-crystalline. Upon the introduction of an oligomer or polymer into an LC material, an increase in temperature (and or other factors) may cause the order parameter of the LC material to decrease. A change in energy can cause a phase transition which in turn will indicate whether a material is more akin to a liquid or a solid. Polymers are long, flexible molecules that can have side chains and varying repeat units.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Per claims 2 and 45: The means for reducing energy is an oligomer or short chain polymer within the LC material at the cell walls.

Claims 2 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bryan-Brown et al. (USPN 5,754,264) in view of Wu et al. (USPN 5.661,533). Bryan-Brown does not specify that an oligomer or short-chain polymer can be used as a means for reducing energy; however, Bryan-Brown does disclose that a rubbed polymer can be used to simultaneously vary surface pretilt and anchoring energy although to do so would not allow for independent variation of pretilt and anchoring energy [Col. 1, Lines 61-65]. Furthermore, Wu et al. teaches that a surfactant may be used to lower surface energy [Col. 5, Lines 19-22]. Polymers and similar molecules are surfactants. An oligomer is a polymer or polymer intermediate containing relatively few structural units. It would have been obvious, at the time the invention was made, to use a polymer or similar / related molecule to reduce anchoring energy.

Claims 3-6, 10 and 46-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bryan-Brown et al. (USPN 5,754,264) in view of Wu et al. (5,661,533) in further view of Japanese Patent Application JP04269721A, and Yamagishi et al. (USPN 5,011,624) and in further view of Onishi et al. (USPN 5,450,220).

Per claims 3-6, 10 (LCD) and 46-49:

- Means for reducing anchoring energy:
  - is an oligomer containing esters, thiols, and/or acrylate monomers within the LC material at the cell walls

    Japanese Patent Application JP04269721A discloses a liquid crystal spacer bead made of polymer that has a monomer of the group (not limited to): acrylic acid, methacrylic acid, and esters on the surface of the bead. The modified surface has a high water wettability. It would have been obvious, at the time the invention was made, to use an oligomer containing materials that would give it a high water wettability for the purpose of lowering surface energy.
- The oligomer or short chain polymer:

- has imperfect solubility in the LC material

  Yamagishi et al. discloses a liquid crystal having solubilities different from those in a polymer and monomer respectively [Col. 2, Lines 50-55] for the purpose of making a flexible or rigid material and with varying degrees of contrast and transparency.

- has a physical affinity for the surface of the cell wall

  Amphiphilic compounds (surfactants) tend to migrate to a liquid's surface and will thus have an affinity for the surface of a cell wall.

- retains a substantially liquid like surface at the polymer and LC material interface

  When an oligomer / polymer is not polymerized, it will retain a liquid-like surface at the polymer / LC material interface.

- has a glass transition temperature below the operating temperature range of the device (LCD)

  Onishi et al. discloses a glass transition temperature range for a polymer resin in a liquid crystal. Onishi discloses the importance of the glass transition temperature to display quality. Display is affected by temperature and thus the glass transition temperature of both the polymer and liquid crystal must be taken into account [Col. 2, Lines 61-65]. It would have been obvious, at the time the invention was made, to use a polymer with a glass transition temperature lower than that of the device to ensure a high quality display.

Claims 53-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bryan-Brown et al. (USPN 5,754,264) in view of Coulson (WO 87 / 06020) in further view of Bryan-Brown et al. (WO 97 / 14990).

Per claims 53-59:

- The LC material is:
  - chiral smectic, the alignment directions on the two cell walls are substantially parallel, and the device is a bistable device
  - non-chiral smectic
  - smectic A

Coulson (WO 87 / 06020) discloses a bistable chiral smectic liquid crystal device in which the alignment directions may be parallel in the same or opposite directions. Coulson further discloses that a chiral mixture may be added to a non-chiral or racemate LC material. It would have been obvious, at the time the invention was made, to further include a smectic A material because when a liquid crystal is in a chiral nematic phase, and has smectic phases present, these phases may be either smectic A or smectic C.

It would have been obvious, at the time the invention was made, to further include a means for reducing surface energy to affect tilt and pitch.

- The alignment treatment:
  - (smectic) the alignment directions on the two cell walls are non-parallel
  - (smectic) the alignment is provided by a grating surface
  - (smectic) the alignment is provided by a rubbed polymer surface
  - (smectic) the other cell wall has no azimuthal alignment direction, and both cell walls are treated with the means for reducing anchoring energy

  Coulson (WO 87 / 06020) further discloses that the alignment directions may be parallel thus suggesting that the alignment directions may be non-parallel. The use of a grating surface and or a rubbed polymer surface to affect alignment is commonly done in the art of LC molecular alignment. Bryan-Brown (WO 97 / 14990) discloses that a cell wall may have no alignment direction and discloses a surface treatment on another cell wall.

Claims 13-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hatano et al. (USPN 5,920,368) in view of Yang et al. (USPN 5,847,798).

Per claims 13-17 (method): providing a layer of an LC material contained between two spaced cell wall carrying electrodes structures and an alignment treatment on at least one wall ... the step of reducing anchoring energy at the surface alignment on one or both cell walls wherein the oligomer or short chain polymer is formed by polymerization of reactive low molecular weight materials in solution in the LC fluid ... (prior to or after) ... its introduction between the cell walls ... further including the step of polymerization of reactive low molecular weight

materials in the presence of an inert solvent which is then removed and the resulting polymer dissolved in the LC material prior to its introduction between the cell walls.

Hatano et al. does not have a step of reducing anchoring energy; however, Yang et al. discloses that surface alignment may be accomplished by treating relevant surfaces with a detergent or chemicals [Col. 4, Lines 35-40]. Detergents are commonly used to reduce anchoring energy as previously noted. Hatano further discloses a composite LC and polymer material in which a composite material may be formed simultaneously with the formation of the polymer and Hatano further discloses the use of a solvent soluble with the LC material. Hatano further discloses that the additional material soluble with the LC material should be selected such that it does not impair operation of the display element including the composite material [Col. 4, Lines 50-54]. It would have been obvious, at the time the invention was made, to include steps of forming the polymer in the LC material solution and then to add a solvent to dissolve the polymer so as not to interfere with the LC fluid itself for maximum switching and increased operation of the display element.

Claims 18-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bryan-Brown et al. (USPN 6,249,332 B1) in view of Bryan-Brown et al. (USPN 5,754,264) in further view of Amstutz et al. (USPN 4,697,884).

Per claims 18-32: two cell walls enclosing a layer of nematic LC material; electrode structures on both walls for applying an electric field across the LC layer; a surface alignment on both cell walls providing alignment direction to LC molecules and arranged so that a twisted nematic structure is formed across the LC layer; means for distinguishing between the two different optical states of the LC material; characterized by means for reducing zenithal anchoring energy in the surface alignment on one or both cell walls.

- Means for reducing zenithal anchoring energy is:
  - an oligomer coated onto the inner surface of one or both cell walls either spread on the surface or added to the LC material
  - oligomer incorporated in the LC material
  - N65 or MMXM035

- a material containing esters, thiols, and/or acrylate monomers
- reduces the LC material order parameter at or adjacent the cell walls
- changes the phase of the LC material at or adjacent the cell walls

- Means for reducing azimuthal anchoring energy

  Bryan-Brown et al. (USPN 6,249,332 B1) discloses a means for distinguishing between two different optical states of an LC material. The use of oligomers as a technique of reducing anchoring energy has been previously noted. N65 is, furthermore, a material comprising esters and acrylate monomers. It would have been obvious, at the time the invention was made, to use N65 as a means for reducing anchoring energy. Reduction of order parameter and phase change have also been previously noted in this Office Action.

- Surface alignment:
  - provides a pretilted nematic alignment on both cell walls

    Bryan-Brown (USPN 6,249,332 B1) discloses a surface treatment on at least one cell wall permitting nematic LC molecules to adopt a given pretilt angle [Col. 3, Lines 19-25].
  - is provided by a rubbed polymer, a photo-oriented polymer, or an obliquely evaporated inorganic material

    Bryan-Brown et al. (USPN 5,754,264) discloses rubbing and or oblique evaporation as alignment techniques [Col. 1, Lines 46-52]. Furthermore, these are common techniques in the art of LC molecular alignment.
  - layer is a surface monograting with an asymmetric groove profile

    Disclosed in Bryan-Brown (USPN 5,754,264).
  - alignment directions on the two surfaces are substantially perpendicular

    Amstutz et al. (USPN 4,697,884) discloses a perpendicular orientation direction.

- LC director twists:

- by about 90^0 throughout the thickness of the cell

  Amstutz discloses twist angles of 90^0 [Col. 1, Line 55].

- is greater than 180^0 and less than 360^0

  Amstutz discloses LC twists of equal to or greater than 180^0 and less than 360^0. [Amstutz, Col.2, Lines 22-23].

- Nematic LC material contains a small amount (<5%) of a chiral dopant material

  Amstutz discloses the use of a chiral dopant to obtain a given thickness to pitch ratio. The level of chiral dopant is selected to obtain a natural pitch and to obtain given desired twist angles. It would have been obvious, at the time the invention was made, to vary chiral dopant to obtain desired twist angles. Furthermore, it is often desirous to use small amounts of chiral dopants (as opposed to large amounts) because (1) chiral dopants are expensive and difficult to synthesize, (2) they can negatively affect LC properties (when used in large amounts) such as: dielectric anisotropy, viscosity, driving voltage, or switching times (Parri et al. USPN 6,217,792 B1).

Claims 33-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bryan-Brown et al. (USPN 5,754,264) and (USPN 6,249,332 B1) in view of Wu et al. (USPN 5,661,533) in further view of Barbieri et al. (USPN 6,327,017 B2).

Per claims 33-43: two cell walls enclosing a layer of nematic LC material; electrode structures on both walls; a surface alignment on one or both cell walls providing two alignment directions to LC molecules with an amount of surface pretilt; means for distinguishing between switched states of the LC material; characterized by means for reducing inelastic azimuthal memory energy in the surface alignment on one or both cell walls

- Means for reducing zenithal anchoring energy

  Barbieri et al. discloses a means for breaking a given anchoring energy.

- Means for reducing anchoring energy is an oligomer or short chain polymer

- either spread on the surface or added to the LC material

  Oligomers or short chain polymers as means for reducing anchoring energy have been previously addressed.
- selected from: N65, HDVE, BVE, EGTG, NDT

  N65 as a means for reducing anchoring energy has been previously addressed.
- is an amount up to 10% by weight in the LC material
- chain length is less than 100 repeat units

  The use of a small amount of oligomer / polymer and short chain length to reduce anchoring energy (as opposed to the use of a large amount) is necessary in order to not interfere with the LC material and this amount is common in the art.
- parameters of type, concentration, chain length, are arranged to reduce the LC order parameter at or adjacent the cell wall
- parameters of type, concentration, chain length, are arranged to change the phase of LC at or adjacent the cell wall
- is a material precured (prior to / after) introduction between the cell walls
- alignment is provided by a bigrating surface

  Changing order parameter or phase has been previously addressed.

  The use of a bigrating surface to affect alignment is common in the art of liquid crystal molecular alignment. Precuring is common in the art.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeanne A. Di Grazio whose telephone number is (703)305-7009. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William Sikes can be reached on (703)308-4842. The fax phone numbers for the organization where this application or proceeding is assigned are (703)746-8741 for regular communications and (703)746-8741 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

Jeanne Andrea Di Grazio

James A. Dudek, Primary Examiner

JDG
September 17, 2002